

PAKISTAN ELECTRIC POWER COMPANY
(PEPCO)

SPECIFICATION DDS-98:2011



SPECIFICATION FOR ADVANCED METERING
INFRASTRUCTURE (AMI)

SERVICES DIVISION (NTDC) DESIGN & STANDARDS
DEPARTMENT

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No. 3871-87/CEDSI/12-262

Dated: 15-08-2012

Chief Executive Officers,
All DISCOs

Subject: - AMENDMENT NO.1 DATED 09.07.2012 IN THE ADVANCED
METERING INFRASTRUCTURE (AMI) SPECIFICATION NO. DDS-
98:2011.

Enclosed please find herewith copy of Specifications No. DDS-98:2011
for Advanced Metering Infrastructure (AMI) for your information and record please.

DA/As above.

Zubair
(ZUBAIR MALIK)

Chief Engineer (D&S) NTDC

Cc to:-

1. General Manager (Services Division) NTDC, Wapda House, Lahore
2. Chief Engineer (Material Inspection) NTDC, Sunny View, Lahore.
3. All Meter manufacturers.

M/s - Micro Tech

SPECIFICATION NO. DDS-98:2011

SPECIFICATION FOR ADVANCE METERING INFRASTRUCTURE (AMI)

AMENDMENT NO. 1

DATED 9TH JULY, 2012

1. Amend clause 6.1 as under:-

Relay/Contractor must have the capability of connect and disconnect the consumer output phase lines simultaneously in case of over loading and non-payment.

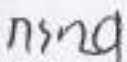
2. Amend clause 7.1 as under:-

Refer to DDS-110:2012 MDC specification.

3. Amend clause 7.4 as under:-

Refer to DDS-110:2012 MDC specification.

4. Replace Annexure-I with AMI Network Architecture (Attached).

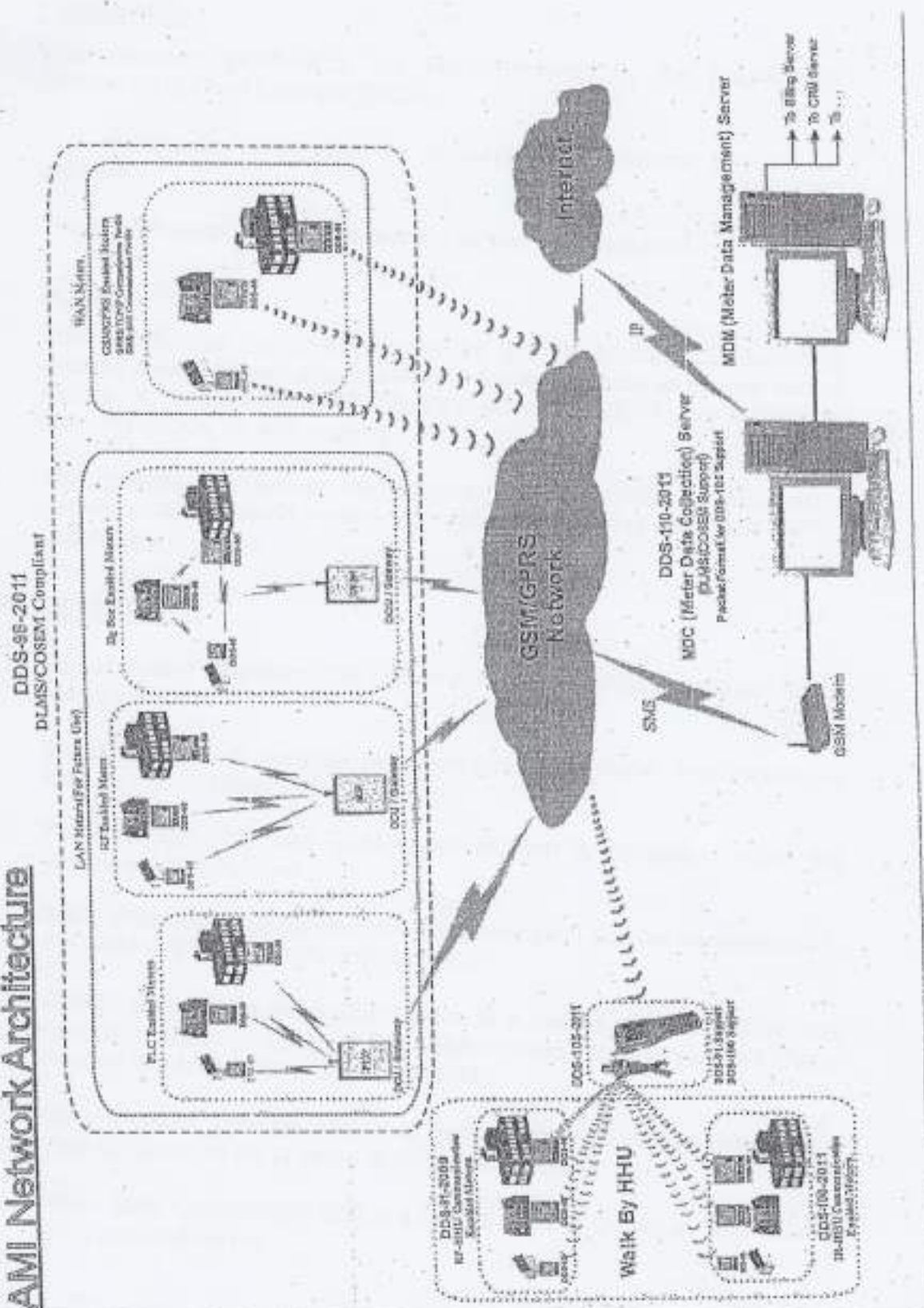

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DY. MANAGER (DE)


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(ZUBAIR MALIK)
CHIEF ENGINEER (D&S)

4. Network Architecture:

AMI Network Architecture



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SPECIFICATION FOR ADVANCED METERING INFRASTRUCTURE (AMI)

0.0 FOREWARD:

- 0.1 This standard specification has been prepared by the Engineering Directorate of Chief Engineer (D&S).
- 0.2 This specification is intended for procurement of material and not for contract.
- 0.3 This specification is subject to revision as and when required.

1.0 SCOPE:

- 1.1 This specification has been prepared for the introduction of GSM/GPRS enabled energy meters and GSM/GPRS Modem/Module as integral part of meters of specifications DDS-50, DDS-60 and DDS-65 that should be used in DISCOs for AMI system.
- 1.2 This specification covers the aspects of GSM/GPRS communication between AMR enabled meters and AMR server using SMS and GPRS technology.

2.0 DEFINITIONS:

- 2.1 **Manufacturer Identifier:** The unique numeric identification of each meter manufacturer.
 - 2.2 **Meter Type:** Each separate meter product of the meter manufacturer is identified using Meter Type.
 - 2.3 **Payload:** Metering data GSM communication is composed within the structure called Payload.
 - 2.4 **SMS:** Short Message Service is a communication service standardized in the GSM mobile communication system.
 - 2.5 **GPRS:** General Packet Radio Service is a packet oriented mobile data service available to users of the cellular communication systems Global System for Mobile Communication (GSM).
 - 2.6 **RTU:** Remote Terminal Unit is a device, which interfaces telemetering data of objects in the physical world to central server.
 - 2.7 **DCU:** Data Concentrator Unit is a device used to Communicate between RTU and AMI server.
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3.0 NETWORK ARCHITECTURE:

Proposed Network Diagram is given in Annexure -I

4.0 RTU (Remote Terminal Unit) SPECIFICATION:

4.1 METERS:

- 4.1.1 Meters to be supplied by the vendors should comply with their respective WAPDA standards viz. DDS-50:2007, DDS-60:2007 and DDS-65:2003 (amended to date).
- 4.1.2 The meters should have built-in communication device i.e. GSM/GPRS Modem/Module for direct communication to server over SMS and GPRS.
- 4.1.3 Meters should be capable of generating the query response originated by the host system/sever.
- 4.1.4 Meters should be capable of sending data to the host system at a preprogrammed interval and two (2) IP addresses should be programmed in the GSM/GPRS module and three (3) number of SIMS (GSM subscriber) should be programmed for communication with the meter and meter can only be communicated through these SIMS for downloading data.
- 4.1.5 Meter should send data to the host system with time and date stamp when alerts/events generated inside the meter including the CT fail or CT bypass.
- 4.1.6 Meter time should be synchronized to Host Server from time to time automatically.
- 4.1.7 The meter should be multi vendor compliant and the protocols to be used for communication following international standards DLMS/COSEM.
- 4.1.8 Load profile and Event Data should be in the format as defined in the meter reporting software of relevant specifications.
- 4.1.9 Load limit device (Relay/Contactor) may be provided as per demand in the meters to operate from server automatically if load exceeds than the predefined load limit.

5.0 GSM/GPRS MODEM/MODULE SPECIFICATION:

- 5.1 The GSM/GPRS Modem and antenna shall be integral part of the meter.
- 5.2 Quad-Band GSM/GPRS 850/900/1800/1900MHz.
- 5.3 Compliant to GSM phase 2/2+

Class 4 (2W @ 850/900MHz)

Class 1(1W @ 1800/1900MHz)

LA

- 5.4 The Modem shall have the capability for SMS and GPRS communication.
- 5.5 The modem shall have single LED in the front, which should be visible from the distance.
- 5.6 The LED shall indicate the operational status of the modem like:
- i) Fast blinking LED indicates absence of SIM card or no network service or insufficient signal strength.
 - ii) OFF LED indicates modem is not working.
 - iii) Slow blinking LED indicates healthiness of the modem and is registered to the GSM network.
 - iv) Data communication indication should be provided on LCD.
- 5.7 SIM card shall be field replaceable.

6.0 RELAY/CONTACTOR SPECIFICATION:

- 6.1 Relay/Contactor must have the capability of connect and disconnect the consumer output for each phase in case of over loading and non payment.
- 6.2 Relay/Contactor should be able to reconnect after preprogrammed time interval and keep connected within preprogrammed threshold otherwise disconnected.
- 6.3 Consumer load threshold for disconnection and number of retries should be programmable.
- 6.4 Relay/Contactor should be operated remotely from server.

7.0 AMR SERVER/ HOST SOFTWARE:

- 7.1 AMR Server/Host Software must be DLMS/COSEM compliant and the host software should be capable to provide all metering data mentioned in meter reporting software in relevant WAPDA/PEPCO specifications.
- 7.2 The host software shall provide GUI (Graphical User Interface) for users to initiate data queries and receive responses.
- 7.3 The host software must have capabilities to store and report all metering data in a database management system as required in the relevant meter specifications reporting software like billing data, event data, load profiles etc.
- 7.4 The database shall have redundant hard drives and there should be at least one mirroring server.
- 7.5 The database server should have backup interface for CD/DVD.
- 7.6 The billing interface will generate billing data to be used in DISCO's customer information and billing system in the form of .csv format.

8.0 DCU Specification:

DCU Specification is given in Annexure-II

9.0 TESTING SOP:

Testing Method of GSM/GPRS enabled meters is given in Annexure-III.

10.0 SAMPLE:

The sample requirement is as per relevant meter specifications.

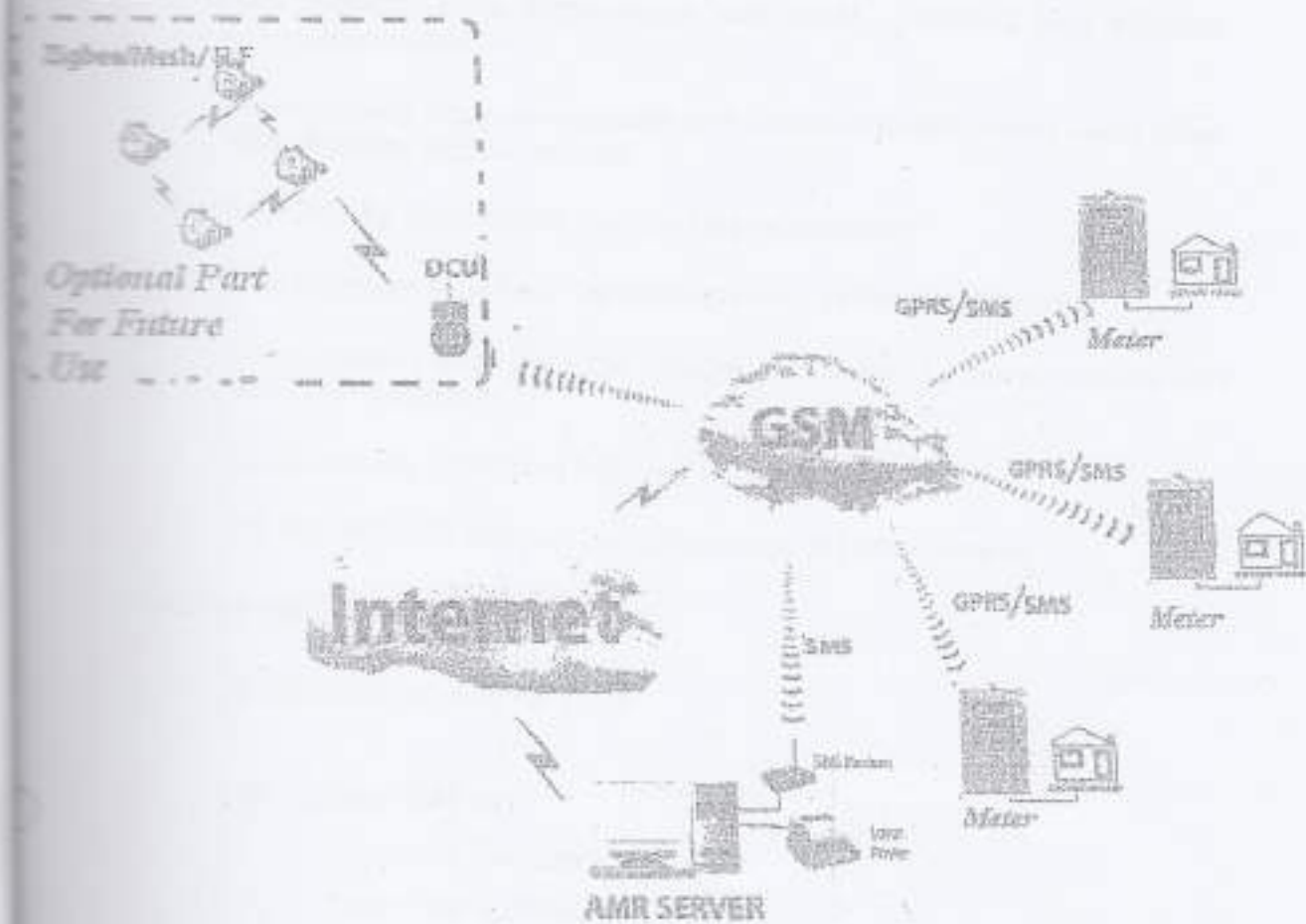
11.0 PROTOTYPE:

The prototype requirement is as per relevant meter specifications.

12.0 TESTING AND INSPECTION:

Inspection requirement is as per relevant meter specifications in addition to verification of GSM/GPRS features.

 (ASHFAQ AHMAD) DT. MANAGER (DISTT. ENGG.)	 16-03-11 (DR. RANA ABUL JABBAR KHAN) MANAGER (DISTT. ENGG.)	 (INAYAT HUSSAIN) CHIEF ENGINEER (D&S)
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Annex-I*Network Architecture*

Annex-II DCU Specification

Data Gateway for LAN/WAN Enabled Meters

Data Gateway shall act as a gateway/bridge between the WAN connected host software and LAN connected meters.

Data Gateway shall communicate with WAN connected host software using GSM/GPRS.

Data Gateway shall communicate with LAN connected meters using either RF433MHz or ZigBee protocol.

SIM Card for GSM/GPRS shall be field replaceable.

Data Gateway shall have minimum capacity to handle 100 nodes.

Data Gateway shall have the required capability of storing relevant LAN and WAN addresses.

Data Gateway shall have following I/O ports:

RS 485/RS 232/USB port for configuration of Data Gateway

Communication Interfaces:

GSM/GPRS Module for WAN

RF 433MHz for LAN

Operating Frequency: 433 MHz

Data Rate: 4.8Kbps

Modulation Technique: FSK

RSSI: Better than or equal to -100dBm

ZigBee for LAN:

Operating Frequency: ISM 2.4 GHz

Network Technology: Mesh

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Technical characteristics of DCU shall be as under:

Power Supply:

3 Phase 4 wire 3x230/400VAC at 50Hz should also be operational on 2 wire.

IP Code (Environmental Protection):

Protection against penetration of dust & water: IP54

Operating Temperature:

-25°C to + 60°C

Status Indicators:

Power: Indicates the availability of power to the DCU.

WAN: Indicates communication status with the host software.

LAN: Indicates communication status with the meter.

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Annex-III

SOP

FOR

TESTING OF GPRS/GSM ENABLED ENERGY
METERS

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Additional Tests & Limits of Testing for GPRS/GSM Enabled Meters

GPRS Enabled Meters are generally considered as Electronic Meters with the additional functionality for remote communication in GSM/GPRS mode. There exist certain conditions in which the normal test procedure or limits already specified for metering need to be reviewed keeping in view the requirements of GSM/GPRS system.

This document addresses only the additional requirements for ensuring successful meter operation with GSM/GPRS module during communications.

1. Power Requirement (IEC 62053-61 Clause 4.3)

The specification of general electronic Meter addresses the Power Requirements of non-multi-functional and non-multi-energy Electronic Meters. But the GPRS/GSM modules attached in a GPRS/GSM enabled meters do have certain Power Requirements.

These requirements are properly addressed in IEC 62053-61. The user and manufacturer should consider that first of all, the meter is multi-energy as well as multi-functional. Also it has a Communication Device installed within the meter deriving energy from the Main's Power Supply.

The Power Loss of GPRS/GSM Enabled Meter may increase due to additional Load of GPRS/GSM Module in normal operating conditions and the VA burden may increase also. During Transmission/Reception of GPRS/GSM Data the power requirements increase. The total power loss should not exceed the values given in IEC 62053-61.

2. Low Voltage Application.

The Specification of general electronic meters also addresses the Voltage Limit Range of Operation as well as Specified Range of Operation. In case of GPRS/GSM Enabled Meters, this limit is also applicable.

3. Test Including Testing at Different Frequencies other than Line Frequency (CISPR 22 Clause 3.1)

The normal electronic meters are tested for its Immunity to EMC and for EMC Emission (both radiated and conducted). This testing cannot hold true for GPRS/GSM enabled meters because the GPRS/GSM enabled meters itself are Radiating Devices.

CISPR 22 which is the standard for Testing of Emissions clearly states that the ITEs (Information Technology Equipment) that have their own radiating devices built in are out of scope of this standard and therefore, National Radio Regulations have to be applied. Electricity Meters are not covered under the Pakistan Telecommunication Authority (PTA) regulations. Therefore, an FCC, USA/European Directives approval, certification, and test reports for the GSM/GPRS modules should be provided.

4. Extended Temperature Range

The meter shall fulfill the requirements set forth in the WAPDA specifications except for the test, for successful communication which shall be conducted within temperature range of -25°C to $+70^{\circ}\text{C}$.

5. EMC Requirements (IEC 62052-11)

All the EMC requirements and conditions specified and applicable on the normal Electronic Meter should also be applicable to the GPRS/GSM Enabled Meters accordingly.

6. All other Electrical Requirements (IEC 62053-21)

All other electrical requirements and conditions specified and applicable on the normal Electronic Meter shall also apply to the GPRS/GSM enabled meters accordingly.

Testing of GPRS/GSM Enabled Meters.

The Type-Tests performed on the meter generally fall in three categories.

1. The tests during which the meter is not energized:
 2. The tests during which the meter is energized but accuracy is not taken.
 3. The tests during which the meter is energized and accuracy is taken.
- Methods for testing the GPRS/GSM Capability of the Meter in each category is defined as under: -

Category 1

Tests during which meter is not energized.

Testing Methodology

The Type Tests in which meter is not energized, the meter should be checked for communication before and after application of tests. This is to ensure that the communication System of the meter is not effected by the application of test.

Application Methodology

To execute this schema, meter should be energized before application of the test and its communication is checked. Then the meter is de-energized and the required test is performed. After application of test and its success, the meter is again energized and its communication is verified.

Interpretation of Results

When the communication is confirmed, the meter is considered to be accepted.

List of Tests Under Category 1

Sr. No.	Test Name	Specification
	Tests Insulation Properties	As per Relevant Specifications
1	Impulse Voltage test for circuits and between circuits.	
2	AC Voltage Test (4kV)	
3	Insulation Resistance Test	
	Tests of the effect of the climatic	
4	Dry Heat Test	
5	Dry Test	
6	Solar Radiation Test	
	Mechanical Tests	
7	Spring Hammer Test	
8	Shock test	
9	Vibration Test	
10	Test of Penetration of Dust Particles	
11	Test of Penetration of Water	

Category 2

Tests during which Meter is Energized but Accuracy is not Taken.

Testing Methodology

This category addresses the Type Tests in which meter is energized with the voltage applied at the meter terminals and with or without current flowing through the meter but accuracy is not observed.

The meter undergoing the tests under this category should be checked for successful communication during application of the specified test. It should also comply with the test conditions and should not affect the result. This is to ensure that the communication of the meter is not affecting the meter in particular test conditions.

In cases where Temporary Loss of Function of meter is allowed, the same is applicable to the communication enabled meter. Example of such test is the Electrostatic Discharge Test.

Application Methodology

To execute this scheme, meter should be energized according to the test specification. The communication with the meter is performed during the application of Test conditions.

The meter communication shall be checked before and after application of the test conditions.

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Interpretation of Results

If the meter communicates properly and the test results remain within the permissible limits during this communication then the meter is considered to comply with the test standard.

List of Tests Under Category 2

Sr.#	Test Name	Specification
	Test of Accuracy requirement	As per Relevant Specifications
1	Test of no-load condition	
2	Test of Starting Current	
	Tests of Electrical requirements	
3	Test of Power Consumption of Voltage Circuit	
4	Test of Power Consumption of Current Circuit	
5	Test of Effect of Voltage Dips & short Interruption)	
6	Test of Influence of Short Time Over Current	
7	Test of Temperature Rise of Terminals	
8	Immunity to Earth Fault	
	Tests of Electromagnetic Compatibility (EMC)	
9	Test of Immunity to Electrostatic Discharges	
	Tests of the effect of the climatic environments	
10	Damp Heat Cycle Test	
	Miscellaneous Requirements	
11	Voltage Limit Range of Operation	
12	Test of meter Operation / Recording	

Category 3

Tests during which meter is energized & accuracy is also taken.

Testing Methodology

This category addresses the Type Tests in which meter is energized with the voltage applied at the meter terminals as well as current flowing through the Meter to test the operation and accuracy of the meter under application of test conditions.

The meter undergoing the tests under this category should be checked for successful communication during application of the specified test. It should also comply with the test conditions and should not affect the accuracy results except within the permissible tolerance.

Application Methodology

To execute this scheme, meter should be energized according to the test specification. The communication with the meter is performed during the application of Test condition. Whenever possible, the meter shall be checked for communication during the test condition; otherwise it shall be checked before and after the test condition is applied.

Interpretation of Results

If the meter communicates properly and the accuracy results remain within the permissible limits during, before, and after (as applicable) then the meter is considered to comply with the test standard.

List of Tests Under Category 3

Sr.#	Test Name	Specification
	Test of Accuracy requirement	As per Relevant Specifications
1	Test of Accuracy	
2	Test of Meter Constant	
	Tests of Influence quantities	
3	Voltage Variation	
4	Frequency Variation	
5	Reverse Phase Sequence	
6	Voltage Unbalance	
7	Harmonic Content in current & voltage circuit	
8	Odd Harmonics in the current circuit	
9	Sub Harmonics in the AC Current	
10	Continuous magnetic induction of external origin	
11	Magnetic induction of external origin 0.5mT	
12	Influence of Radar Magnet (0.5 Tesla)	
13	Test of Ambient Temperature Influence	
14	Test of Temp at Extreme Condition (-25°C to +70°C)	
	Tests of Electromagnetic Compatibility (EMC)	
15	Fast Transient Burst Test	
16	Surge Immunity Test	
17	Test of Immunity to Electromagnetic RF Fields (Conducted Disturbance)	
18	Temp Oscillatory Waves Immunity Test	